PREVENTIVE MAINTENANCE CHECKLIST

BUILDING ENVELOPE

Windows and Skylights

- Replace broken or cracked window panes.
- Replace worn weatherstripping and caulking.
- Replace defective sealing gaskets and cam latches.

Doors

- Replace worn weatherstripping and caulking.
- Check automatic door closers for proper operation.
- Replace defective gaskets on garage doors and other overhead doors.

Exterior Surfaces

- Replace worn weatherstripping, caulking, and gaskets at exterior joints and at openings for electrical conduits, piping, through-the-wall units, and outside air louvers.

Stairwells and Shafts

- Replace worn seals and weatherstripping in stairwells, on penthouse machine-room doors, in elevator shafts, in vertical service shafts, and on basement and roof equipment-room doors when they are connected by a vertical shaft that serves the building.

HVAC B AIR-CONDITIONING EQUIPMENT

Refrigerant Circuit and Controls

- Inspect the moisture-liquid indicator to ensure that no moisture is in the system.
- Check for and repair refrigerant and oil leaks around the shaft seal, sight glasses, valve bonnets, flanges, flare connections, and the condenser assembly relief valve.
- Check for and repair leaks at pipe joints on equipment, valves, and instrumentation.
- Check for and repair the source of oil spots on connections or under equipment.
- Inspect the liquid line leaving the strainer.
- Listen to the system operate for a few minutes and determine the cause of any unusual sounds.
- Check all gauges frequently to ensure that design conditions are being met.
- Inspect the tension and alignment of all belts and adjust as needed.
- Lubricate motor bearings and all moving parts.
- Inspect the insulation on suction and liquid lines and replace as necessary.

Compressor

- Check for unusual compressor operation, such as continuous running or frequent stopping and starting.
- Listen to the compressor operate for a few minutes and determine the cause of any unusual sounds.
- Check to see that the compressor and motor are securely fastened to the base.
- Check all compressor joints for leakage.
- Inspect instrumentation frequently to ensure that the operating oil pressure and temperature agree with manufacturer=s specifications.

Air-Cooled Condenser

- Check the fanbelt drive and motor to see if they are properly aligned and lubricated.
- Be sure that refrigerant piping connections to the condenser coil are tight. Check for leaks.
- Clean the face of the condenser coil.
- Determine if hot air is being bypassed from the fan outlet to the coil inlet.

Evaporative Condenser

- Inspect piping joints and check for leaks.
- Check for dirt on the coil surface.
- Inspect the air inlet screen, spray nozzles, water distribution hoses, and the pump screen.
- Check to see if the local water supply leaves surface deposits on the coil.
- Follow the manufacturer's guidelines for fan and pump maintenance.

Water-Cooled Condenser

- Clean condenser shells and tubes.

Cooling Towers

- Conduct a chemical analysis to determine if solid concentrations are being maintained at acceptable levels.
- Check the overflow pipe's clearance from the normal operating water level.
- Listen to the fan and determine the cause of any unusual noise or vibration.
- Inspect the V-belt and the alignment of the fan and motor.
- Follow the manufacturer's guidelines for fan maintenance.
- Check to see if the tower is clean.
- Check to see if the intake strainer is clean.
- Determine if air is bypassed from the tower outlet back to the inlet.
- Inspect spray-filled and gravity-distributed towers for proper nozzle performance. Be sure the nozzles are clean.
- Inspect gravity-distributed towers for even water depth in the distribution basins.
- Monitor the effectiveness of any water-treatment programs.

Chillers

- Clean as necessary.
- Inspect for clogging.
- Keep water-side tubing clean and the refrigerant-side free of noncondensables.

Absorption Equipment

- Clean the strainer and seal tank regularly.
- Lubricate flow valves regularly.
- Follow the manufacturer=s instructions for proper maintenance.

Self-Contained Units (window and through-the-wall units, heat pumps, etc.)

- Clean evaporator and condenser coils.
- Clean air intake louvers, filters, and controls.
- Keep airflow from units unrestricted.
- Replace worn caulking in openings between the units and windows or wall frames.
- Check the voltage to ensure that unit is operating at full power.
- Follow applicable maintenance guidelines for compressors, condensers, and fans.

HVAC B HEATING EQUIPMENT

Boilers (General)

- Tune boilers at least annually.
- Inspect boilers for scale deposits, accumulation of sediment, or boiler compounds on water-side surfaces. The rear of the boiler is the area most susceptible to scale.
- Inspect the fire-side of the furnace and tubes for deposits of soot, flash, and slag. Pay particular attention to the fire-side refractory surface. Check the temperature at the gas outlet. Adjust the air-to-fuel ratio for a clean-burning fire.
- Replace door gaskets that do not provide a tight seal.
- Keep a daily log of pressure, temperature, firing rate, and other data. Look for variations as a way to determine the need for tube and nozzle cleaning, pressure or linkage adjustments, and related measures.
- Keep stacks free of haze. Adjust the burner if necessary.
- Tighten linkages when slippage or jerky movements are observed.
- Observe the fire when the unit shuts down. If the fire does not cut off immediately, the solenoid valve may need to be repaired or replaced.
- Clean nozzles or cutoffs on oil-fired units as necessary.
- Check the burner's firing period. If it is too long or too short, controls may be faulty.
- Check the boiler=s stack temperature. If it is too high (more than 1501F above the steam or water temperature), clean the tubes and adjust the fuel burner.
- Inspect all boiler insulation, refractory, and brickwork and the boiler casing for hot spots and air leaks. Repair and seal as necessary.
- Replace all obsolete or little-used pressure vessels.
- Clean mineral or corrosion buildup on gas burners.

Boilers (Fuel Oil)

- Repair oil leaks at pump glands, valves, and relief valves.
- Replace dirty oil-line strainers.
- Inspect oil heaters to ensure that oil temperatures are being maintained according to the manufacturer's or oil supplier's recommendations.

Boilers (Coal-Fired)

- Inspect coal-fired stokers, grates, and controls for efficient operation. Ashes with an excessive amount of unburned coal are usually a sign of inefficient operation.

Boilers (Electric)

- Inspect the electrical contacts and working parts of relays and maintain in good working order.
- Replace dirty heater elements as necessary.
- Adjust controls as necessary.

Central Furnaces, Make-Up Air Heaters, and Unit Heaters

- Clean all heat exchanger surfaces. Adjust the air-to-fuel ratio as necessary.
- Inspect burner couplings and linkages.
- Seal air links in casings as necessary.
- Repair or replace insulation as necessary.
- Follow the manufacturer's suggested guidelines for fan and motor maintenance.

Radiators, Convectors, and Baseboard and Finned Tube Units

- Remove obstructions in front of all units whenever possible. Ensure that air movement in and out of the connector unit is unrestricted.
- Be sure that air collected in the high points of hydropic units is vented to enable hot water to circulate freely throughout the system.
- Clean heat transfer surfaces in radiators, convectors, and baseboard and finned-tube units.

Electric Heating

- Keep the heat transfer surfaces of all electric heating units clean and unobstructed.
- Keep the air movement in and out of the units unobstructed.
- Periodically inspect heating elements, controls, and fans.
- Check reflectors on infrared heaters for cleanliness and proper beam direction.
- Determine if electric heating equipment is operating at the rated voltage.
- Check controls for proper operation.

HVAC B HUMIDIFICATION AND DEHUMIDIFICATION EQUIPMENT

- Remove lint and dust from air dampers, fan parts, the spray changers and diffusers, control starters, and eliminators.
- Check equipment for carryover. Maintain carryover by adjusting eliminator seal gaps, altering damper positions, or changing air velocities.
- Follow the manufacturer=s suggested guidelines for fan and motor maintenance.

HVAC B AIR-HANDLING EQUIPMENT

- Seal leaks in ductwork by taping or caulking and repair or replace ductwork insulation as necessary.
- Check ductwork access openings for obstructions, such as loose hanging insulation (in lined ducts), loose turning vanes and accessories, and closed fire dampers. Adjust, repair, or replace as necessary.
- Inspect for buildup of water, condensation, or moistness on insulation and on equipment walls and floors of air handlers. Ensure drip pans and drains are kept clear and free-running.
- Inspect damper blades and linkages. Clean, oil, and adjust regularly.
- Inspect air valves in dual-duct mixing boxes to ensure full seating and minimum air leakage.
- Inspect mixing dampers for proper operation.
- Clean or replace air filters regularly.
- Clean air heating, cooling, and dehumidification coils regularly.
- Seal leaks around the coils and casing.
- Keep all room air outlets and inlets (diffusers, registers, grills) clean and unobstructed.
- Inspect air washers and evaporative air-cooling equipment for proper operation. Clean damper blades and linkages. Inspect nozzles and clean as necessary.
- Check electronic air cleaners for excessive accumulations on the ionizing and grounding plate section. Replace filter media as necessary. Follow the manufacturer's instructions whenever adjustments or maintenance are required.
- Keep humidifier and dehumidifier air dampers, fan parts, spray changers, diffusers, controls, strainers, and eliminators free of dirt, lint, and other foreign particles.
- Adjust variable air volume boxes so they operate precisely to prevent overheating or overcooling.
- Follow the manufacturer=s guidelines for fan maintenance.

HVAC B MOTORS, ENGINES, AND TURBINES

Motors

- Check the alignment of the motor to the equipment it drives. Align and tighten as necessary.
- Check for and repair loose connections and bad contacts regularly.
- Determine the cause of and repair excessive vibration and repair as necessary.
- Clean motors regularly.
- Lubricate the motor and drive bearings regularly.

- Replace worn bearings.
- Tighten belts and pulleys.
- Check for overheating. If overheating is present, check for functional problems or inadequate ventilation and repair as necessary.
- Balance three-phase power sources to motors.
- Check for overvoltage or low-voltage conditions and correct as necessary.

Engines

- Follow the manufacturer=s recommended maintenance procedures.
- Check fuel consumption and compare it with the designed fuel consumption. If fuel consumption seems to be excessive, determine the cause and correct.
- Record and check cooling-water temperatures daily. If they exceed the manufacturer=s recommendations, check the temperature controls and correct as necessary.

Turbines

- Follow the manufacturer's recommended maintenance procedures.
- Record steam pressure and check turbine speed daily.
- Check the oil level, packing, and governor and throttle valve operation regularly and correct any problems as necessary.
- Record and check bearing temperatures and oil cooler temperatures. If they exceed the manufacturer's recommendations, check the temperature controls and correct as necessary.
- Check for vibration weekly and correct as necessary.

HVAC B FANS AND PUMPS

Fans

- Check for excessive noise and vibration and correct as necessary.
- Clean fan blades.
- Inspect and lubricate bearings regularly.
- Inspect drive belts for proper tension. Adjust or replace as necessary to ensure proper operation.
- Keep inlet and discharge screens on fans free of dirt and debris.

Pumps

- Check for packing wear and repack as necessary. Replace glandular packing with mechanical seals.
- Inspect bearings and drive belts for wear and binding. Adjust, repair, or replace as necessary.

HVAC B PIPES

Hot- and Chilled-Water Piping

- Inspect and test all controls for proper operation and leakage at joints. Adjust, repair, or replace as necessary.
- Check flow measurement instrumentation for accuracy. Adjust, repair, or replace as necessary.
- Repair or replace insulation as necessary. Replace any insulation damaged by water. Determine the source of the water and correct.
- Clean strainers regularly.
- Inspect heating and cooling heat exchangers. Temperature differences may be an indication of air binding, clogged strainers, or excessive amounts of scale. Determine the cause of the condition and correct.
- Remove clogs from vents.

Steam Piping

- Repair or replace insulation on all mains, risers, and branches as well as economizers and condensate receiver tanks as necessary.
- Check the automatic temperature-control system and related control valves and accessory equipment to ensure they are regulating the system properly in the various zones.
- Inspect zone shutoff valves and shut off steam going into unoccupied spaces.
- Adjust, repair, or replace any faulty steam traps.
- Adjust, repair, or replace pressure-reducing and regulating valves and related equipment as necessary.
- Adjust, repair, or replace condensate tank vents as necessary.
- Check the accuracy of recording pressure gauges and thermometers.
- Inspect the pump for satisfactory operation, particularly for leakage at packing glands.
- Correct sluggish or uneven steam circulation.
- Correct any excessive noise in the system, particularly water hammer.
- Repair leaks in the vacuum return system.

HVAC B PNEUMATIC AIR COMPRESSOR FOR CONTROLS

- Repair any air leaks, particularly at connections.
- Note compressor operation. If it seems to run excessively, there could be pressure loss at the controls or somewhere in the piping system. Determine the cause and correct.
- Inspect the air pressure in the supply tank and pressure-regulator adjustment in the supply line for proper limits.
- Check belt tension and alignment.
- Clean or replace air compressor-intake filter pads as necessary.
- Lubricate electric motor bearings according to the manufacturer's recommendations.

LIGHTING

- Wipe lamps clean at regular intervals. Lamps that are exposed to substantial amounts of dirt, dust, grease, or other contaminants should be cleaned more frequently than lamps in a relatively clean atmosphere.
- Maintain luminaire efficiency by properly cleaning the reflecting surfaces and shielding media.
- Replace lens shielding that has yellowed or become hazy with a clear acrylic lens with good nonyellowing properties. A clear glass lens can be considered if it is compatible with the luminaire and does not present a safety hazard.
- Clean ceilings, walls, and floors frequently to improve reflective qualities.
- If daylighting contributes to lighting, wash windows frequently to maintain illumination levels.
- Replace *all* lamps used for area illumination after they have been in service for a substantial portion (approximately 70 percent) of their rated life, instead of simply replacing lamps one at a time as they burn out.

SERVICE HOT WATER

- Inspect pipes and tanks frequently. Repair or replace loose or hanging insulation. If insulation is water-damaged, locate the source of the water, repair it, and install new insulation.
- Repair all leaking faucets.
- Flush the water heater during seasonal maintenance of the heating system.
- Repack circulating pump packing glands to reduce hot water leakage. Replace glandular packing with mechanical seals.
- In the case of oil- or gas-fired water heaters, routinely check for smoky exhaust, high stack temperatures, and high levels of carbon dioxide. Adjust the air-to-fuel ratio to optimum levels (proper settings can be obtained from local utilities and suppliers.)
- Be sure that boiler water covers service hot water coils (if applicable).

COMMERCIAL REFRIGERATION

- Clean display fixtures and cooler coils regularly. Be sure to shut off refrigeration before using water for cleaning.
- Replace worn refrigeration seals.
- Check all electrical circuits for power leaking to the ground.
- Check all systems for the correct refrigerant charge to avoid excessive compressor operation. Shortages usually will show up during low ambient air conditions.
- Check all multishelf fixtures for inoperative fan motors.

ELECTRICAL SYSTEMS

Electrical Distribution System

- Conduct a load survey of the building's electrical distribution system. Check for low-voltage conditions, overvoltage, loose connections and bad contacts, unbalanced voltages, and power leaks to ground.
- Check voltage at the terminals of power and lighting circuits regularly.

Electric Motors

- Lubricate the motor and drives regularly.
- Replace worn motor bearings.
- Keep motors clean.
- Check the alignment between the motor and the equipment it drives and adjust if necessary.
- Tighten belts and pulleys at regular intervals.

Taken from the AEnergy Management -- A Program to Reduce Cost and Protect the Environment,@ Enviro-Management & Research, Inc., Arlington, VA, for U.S. General Services Administration and The Electrification Council, September 30, 1994, pages 3-9 to 3-19.